A SYSTEM OF SYSTEMS ENGINEERING APPROACH TO DESIGN NEW SMARTER AND ENERGY EFFICIENT PRODUCTS

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1. Purpose

The concept of smartness of energy efficient products and systems from a business perspective has been investigated by several authors. The problem of understanding, designing, engineering and governing these technologies requires new concepts.

The emergence of these modern technologies causes a myriad of interconnected systems, which are working together to satisfy the necessities of modern life. The problem of understanding, designing, engineering, and governing these technologies requires new concepts. Development of System of System Engineering (SoSE) is an attempt by the systems engineering and science community to fulfill this requirement.

2. Approach

System of System Engineering approach has been applied in studies to design new smarter and efficient products. SoS enables organizations to approach the design of complex products and systems and its impact across multiple engineering disciplines: mechanical, electrical and software. With this approach, customer requirements are defined early in the development cycle and are implemented through design and system validation from concept to operation.

SoSE are large-scale concurrent and distributed systems that consist of complex systems. Their principal characteristics are: operational and managerial independence, geographic distribution, emergent behaviour, evolutionary development, self-organization, and adaptation.

Although there is no universal definition, SoSE is a complex assemblage of multiple, heterogeneous, distributed systems embedded in networks at multiple levels that evolve over time. They compromise humans, other organisms, and processes that satisfy a set of goals, while they can maintain their operational features, even if some of the component system are removed or new ones are connected.

The main purpose of a SoS model is to understand a very complex system by studying not only its components, but also the system as a whole. This provides the potential to examine possible outcomes, if certain actions are adopted, and thus, identify policies achieving the SoSE goals.

3. Results/Findings

Based on initial values, the optimal design increases product performance from different parameters. The optimal investment plan considers different budgets, components and resources through simulations at each SoSE level. A dynamic resource allocation problem was

proposed for developing optimal designs. Sensitivity analysis of the system parameters can also been performed, as well as developing new strategies.

4. Conclusions

This paper provides a motivation and quest for SoSE when designing smarter and efficient new products. A large number of disciplines and research fields must be integrated towards development and widespread use of smarter efficient products. The SoSE and human engineering approach are critical in supporting and facilitating the development of new smarter and energy efficient products.

It should be emphasized that the aim of the paper was to propose a methodological framework for developing smarter & efficient new products. SoSE isn´t just an approach to product development, it´s a consideration throughout the entire product lifecycle, including product support and maintenance.